7.02

STANDARD OPERATING PROCEDURES FOR TAKING FIELD MEASUREMENTS IN STREAMS, RIVERS, LAKES AND WETLANDS USING HAND HELD METER(S)

Summary

The following is summarized from the Field Guide for Collecting and Processing Stream Water Samples for the National Water Quality Assessment Program (Sheldon L. R. 1994, U.S. Geological Survey Open-File Report 94-455).

Measurements of pH can provide some of the most important limnological information pertaining to a water-body. The pH of a solution is a measure of the effective hydrogen-ion concentration. pH is expressed in logarithmic units using a scale of 1 to 14. Water bodies with a pH of less than 7 are considered acidic; water bodies with a pH greater than 7 are considered basic or alkaline.

Dissolved gases such as carbon dioxide, hydrogen sulfide and ammonia appreciably affect pH. Due to this effect, pH must be taken in the field, as a significant change can occur within several hours or even minutes after sample collection.

Specific conductance is the reciprocal of resistance in ohms and is a measure of the capacity of water or another substance to conduct an electrical current. Specific conductance is reported in microsiemens per centimeter at 25 degrees Celsius. The specific conductance of water is determined by the types and quantities of dissolved substances in the water. Thus specific conductance indicates the concentrations of dissolved solids in water.

The specific conductance of water may change significantly with time because of pollution, precipitation, absorption, ion exchange, oxidation, or reduction. Therefore, specific conductance should be measured in the field.

Temperature and dissolved oxygen measurements may also provide some of the most important limnological characteristics of a water body. Temperature and dissolved oxygen measurements provide valuable information about the biological and biochemical reactions occurring within a water body.

Temperature and dissolved oxygen measurements can be reflections of the reactions taking place in the water body. Therefore, water temperature and dissolved oxygen should be measured in the field.

Interferences

The membrane of a dissolved oxygen electrode is permeable to other gases other than oxygen, such as hydrogen sulfide (H_2S). Caution should be taken when using the membrane electrode in low dissolved oxygen waters since the presence of H_2S may lower the cell sensitivity. This interference can be reduced by frequently changing the membrane and calibrating the electrode.

Equipment and Supplies

- ☐ Hand held meter(s).
- ☐ Maintenance kit (Potassium chloride/KCl solution, spare membranes, batteries, battery charger).
- ☐ Project area map depicting monitoring stations.
- ☐ Field report form.
- ☐ Pen.
- ☐ pH 7 and pH 10 calibrating buffer.
- ☐ D.I. water and squirt bottle.
- ☐ Specific conductance calibration solution. (Solution with known specific conductance.)
- ☐ Power ice auger (winter sampling).
- ☐ Ice skimmer (winter sampling).
- ☐ Meter stick (winter sampling).
- ☐ Sled (winter sampling).
- ☐ Personal Flotation Device.

Streams and Rivers

1. Calibrate the meter using a solution with known specific conductance, pH buffer solutions of 7.0 and 10.0, and calibrate dissolved oxygen accordingly with the atmospheric pressure following owner’s manual.

2. Record calibration information in the equipment calibration log (Figure 7.02.01).

3. Locate the main current of the stream or river. Note: When drilling a hole through the ice, be sure not to disturb the water column with undue agitation.

4. Place the guard over the exposed probes and lower the probe to that depth which is approximately 60% the total water depth below the surface. For example, if the stream is five feet deep, take the measurement three feet below the surface.

5. Read temperature, dissolved oxygen, pH, and specific conductance if using a multi-probe meter and record. If using a single probe meter like the YSI 51b, switch the display to read temperature, wait for the temperature reading to stabilize (30 seconds minimum), record the temperature reading on the stream and river sampling field log (7.02.2), switch the display to read dissolved oxygen, allow the dissolved oxygen reading to stabilize and record the dissolved oxygen concentration on the field report form. NOTE: To achieve an accurate reading some units require a stirring unit or for the sampler to gently move the probe up and down two to three inches to circulate water across the membrane.

Lakes and Wetlands

1. Locate the desired sampling location and anchor boat or drill a hole through ice. Note: When drilling a hole through the ice do not disturb the water column with undue agitation.

2. Record calibration information in the equipment calibration log (Figure 7.02.01).

3. Fill in the station identification information on the field report form. Also, measure and record ice thickness and snow depth in the comments section (winter sampling) (Figure 7.02.3).

4. Calibrate the meter following the manufacturer's recommended procedures for field calibration.

5. Remove the storage cup and replace it with a protective guard. Lower the probe to 0.5 meters depth, or just below the ice.

6. Read the temperature and the dissolved oxygen concentration and record on lake sample record form (Figure 7.02.3). If using a single probe meter like the YSI 51b, switch the display to read temperature, wait for the temperature reading to stabilize (30 seconds minimum), record the temperature reading on the field report form, switch the display to read dissolved oxygen, allow the dissolved oxygen reading to stabilize and record the dissolved oxygen concentration on the field report form. NOTE: To achieve an accurate reading some units require a stirring unit or for the sampler to gently move the probe up and down two to three inches to circulate water across the membrane.

7. Lower the probe to the next depth interval and repeat step 5. Readings should be taken at a maximum of one-meter depth intervals.

8. Repeat step 6 until the bottom is reached.

9. Retrieve probe from bottom of water body, rinse thoroughly and replace the storage cup. Check meter calibration following profile measurements to ensure the precision and accuracy of the measurements. If the meter does not resume its initial air calibration reading, re-calibrate the meter and measure the profile again, repeating steps 4 through 8.

Equipment Calibration Log
North Dakota Department of Health
Division of Water Quality - SWQMP
Telephone: 701.328.5210
Fax: 701.328.5200

Date	**Time**	**Personnel:**
/ /	:	

Dissolved Oxygen Calibration					
Current Barometric Pressure in mm hg	Meter Barometric Reading in mm hg	Set Barometric Pressure to mm hg	Initial DO mg L^{-1}	Final DO mg L-1	Winkler mg L^{-1}

Conductivity Calibration			
Known Conductivity	Initial Meter Reading	Meter Setting	Final Meter Reading

pH Calibration					
Set pH 7	Initial Reading	Final Reading	Set pH 10	Initial Reading	Final Reading

Temperature Check			
Temperature 1	Meter Reading	Temperature 2	Meter Reading

Date	**Time**	**Personnel:**
/ /	:	

Dissolved Oxygen Calibration					
Current Barometric Pressure in mm hg	Meter Barometric Reading in mm hg	Set Barometric Pressure to mm hg	Initial DO mg L^{-1}	Final DO mg L-1	Winkler mg L^{-1}

Conductivity Calibration			
Known Conductivity	Initial Meter Reading	Meter Setting	Final Meter Reading

pH Calibration					
Set pH 7	Initial Reading	Final Reading	Set pH 10	Initial Reading	Final Reading

Temperature Check			
Temperature 1	Meter Reading	Temperature 2	Meter Reading

Figure 7.02.1. Equipment calibration log

Stream and River Sampling Field Log
North Dakota Department of Health
Division of Water Quality - SWQMP
Telephone: 701.328.5210
Fax: 701.328.5200

Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date:___/___/____	Spec. Conduct	Temperature	
		Time: :	pH	D.O.	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date:___/___/____	Spec. Conduct	Temperature	
		Time: :	pH	D.O.	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date:___/___/____	Spec. Conduct	Temperature	
		Time: :	pH	D.O.	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date:___/___/____	Spec. Conduct	Temperature	
		Time: :	pH	D.O.	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date:___/___/____	Spec. Conduct	Temperature	
		Time: :	pH	D.O.	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date:___/___/____	Spec. Conduct	Temperature	
		Time: :	pH	D.O.	

Figure 7.02.2. Stream and River Sampling Field Log

Lake Profile Record Field Log
North Dakota Department of Health
Division of Water Quality - SWQMP
Telephone: 701.325.5210
Fax: 701.328.5200

Project Code:		Project Name:	
Site Identification:		Sampler(s):	
Site Description:			
Date: / /	Time: :	Ambient Temp:	Wind Speed: (mph)
Wind Direction:	% Cloud Cover:	Secchi Disk: (m)	Baro: (mm/Hg)
Chlorophyll-a:	Phytoplankton:	Initial DO:	Final DO:
Sample Depths: ____________ Meters, ___________ Meters, ____________ Meters, ____________ Meters			
Comments:			

Depth (m)	Temp (c)	DO (Mg/L)	pH	Specific Conduct.	Comments

Figure 7.02.3. Lake Profile Record Field Log